

Mathematics
Precalculus: Academic
Unit 6: Sequences & Series

Essential Understandings	<ul style="list-style-type: none"> ▪ Sequences and series can be used to model real-life situations. ▪ Sequences and series provide the foundation for upper level mathematics, especially calculus. ▪ Sequences and series are a direct result of finding patterns.
Essential Questions	<ul style="list-style-type: none"> ▪ What is a sequence? ▪ What is a series? ▪ How are sequences & series related? ▪ What is an arithmetic sequence/series? ▪ What is a geometric sequence/series? ▪ What is sigma (the summation symbol)? ▪ How does the binomial theorem apply? ▪ What are the types of real-life situations where sequences & series can be used as models and prediction tools? ▪ How does the vocabulary of sequences & series apply to the real-life situations they model? ▪ How is a graphing calculator used to work with sequences & series?
Essential Knowledge	<ul style="list-style-type: none"> ▪ A finite sequence/series contains a finite number of terms. ▪ An infinite sequence/series contains an infinite number of terms. ▪ Arithmetic and geometric sequences and series have a common difference or a common ratio, respectively. ▪ Sequence and series formulas are used to find a specific term or a total up to a specific term. ▪ The summation symbol (sigma) can be used to quickly write sequence and series formulas. ▪ Sequences and series can be used as prediction tools. ▪ Sequence and series work can be easily performed on a graphing calculator.
Vocabulary	<ul style="list-style-type: none"> ▪ <u>Terms:</u> <ul style="list-style-type: none"> ○ sequence, series, finite, infinite, terms, factorial, recursive, sigma notation and summation, partial sums, common difference & common ratio, compound interest, arithmetic & geometric sequences & series, Binomial theorem, binomial coefficients, Pascal's triangle, expanding a binomial

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Essential Skills	<ul style="list-style-type: none"> ▪ Evaluate and graph all types of sequences & series ▪ Write and evaluate sigma problems (the summation symbol). ▪ Generate terms in sequences & series ▪ Decide which type of sequence/series to use in a given real-life situation. ▪ Recognize similarities between a linear function and an arithmetic series ▪ Recognize similarities between an exponential function and a geometric series ▪ Manipulate sequences & series in order to use them as modeling and prediction tools. ▪ Use a graphing calculator appropriately to work with the various types of sequences & series. ▪ Use the binomial theorem and Pascal's triangle to generate binomial coefficients for certain types of sequences & series ▪ Use the compound interest formula to model finance problems
Related Maine Learning Results	<p><u>Mathematics</u></p> <p>A. Number Real Number A1.Students will know how to represent and use real numbers.</p> <ol style="list-style-type: none"> a. Use the concept of nth root. b. Estimate the value(s) of roots and use technology to approximate them. c. Compute using laws of exponents. d. Multiply and divide numbers expressed in scientific notation. e. Understand that some quadratic equations do not have real solutions and that there exist other number systems to allow for solutions to these equations. <p>B. Data Measurement and Approximation B1.Students understand the relationship between precision and accuracy.</p> <ol style="list-style-type: none"> a. Express answers to a reasonable degree of precision in the context of a given problem. b. Represent an approximate measurement using appropriate numbers of significant figures. c. Know that most measurements are approximations and explain why it is useful to take the mean of repeated measurements.

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**Related
Maine Learning
Results**

Data Analysis

B2.Students understand correlation and cause and effect.

- a. Recognize when correlation has been confused with cause and effect.
- b. Create and interpret scatter plots and estimate correlation and lines of best fit.
- c. Recognize positive and negative correlations based on data from a table or scatter plot.
- d. Estimate the strength of correlation based upon a scatter plot.

B3.Students understand and know how to describe distributions and find and use descriptive statistics for a set of data.

- a. Find and apply range, quartiles, mean absolute deviation, and standard deviation (using technology) of a set of data.
- b. Interpret, give examples of, and describe key differences among different types of distributions: uniform, normal, and skewed.
- c. For the sample mean of normal distributions, use the standard deviation for a group of observations to establish 90%, 95%, or 99% confidence intervals.

B4.Students understand that the purpose of random sampling is to reduce bias when creating a representative sample for a set of data.

- a. Describe and account for the difference between sample statistics and statistics describing the distribution of the entire population.
- b. Recognize that sample statistics produce estimates for the distribution of an entire population and recognize that larger sample sizes will produce more reliable estimates.
- c. Apply methods of creating random samples and recognize possible sources of bias in samples.

Probability

B5.Students understand the relationship of probability to relative frequency and know how to find the probability of compound events.

- a. Find the expected frequency of an event.
- b. Find the expected value of events.
- c. Find the probability of compound events including independent and dependent events.

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<p>Related Maine Learning Results</p>	<p>C. Geometry Geometric Figures C1.Students justify statements about polygons and solve problems. a. Use the properties of triangles to prove theorems about figures and relationships among figures. b. Solve for missing dimensions based on congruence and similarity. c. Use the Pythagorean Theorem in situations where right triangles are created by adding segments to figures. d. Use the distance formula. C2.Students justify statements about circles and solve problems. a. Use the concepts of central and inscribed angles to solve problems and justify statements. b. Use relationships among arc length and circumference, and areas of circles and sectors to solve problems and justify statements. C3.Students understand and use basic ideas of trigonometry. a. Identify and find the value of trigonometric ratios for angles in right triangles. b. Use trigonometry to solve for missing lengths in right triangles. c. Use inverse trigonometric functions to find missing angles in right triangles. D. Algebra Symbols and Expressions D1.Students understand and use polynomials and expressions with rational exponents. a. Simplify expressions including those with rational numbers. b. Add, subtract, and multiply polynomials. c. Factor the common term out of polynomial expressions. d. Divide polynomials by $(ax+b)$.</p>
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<p>Related Maine Learning Results</p>	<p>Equations and Inequalities</p> <p>D2.Students solve families of equations and inequalities.</p> <ol style="list-style-type: none"> a. Solve systems of linear equations and inequalities in two unknowns and interpret their graphs. b. Solve quadratic equations graphically, by factoring in cases where factoring is efficient, and by applying the quadratic formula. c. Solve simple rational equations. d. Solve absolute value equations and inequalities and interpret the results. e. Apply the understanding that the solution(s) to equations of the form $f(x) = g(x)$ are x-value(s) of the point(s) of intersection of the graphs of $f(x)$ and $g(x)$ and common outputs in table of values. f. Explain why the coordinates of the point of intersection of the lines represented by a system of equations is its solution and apply this understanding to solving problems. <p>D3.Students understand and apply ideas of logarithms.</p> <ol style="list-style-type: none"> a. Use and interpret logarithmic scales. b. Solve equations in the form of $x + b^y$ using the equivalent form $y = \log_b x$. <p>Functions and Relations</p> <p>D4.Students understand and interpret the characteristics of functions using graphs, tables, and algebraic techniques.</p> <ol style="list-style-type: none"> a. Recognize the graphs and sketch graphs of the basic functions. b. Apply functions from these families to problem situations. c. Use concepts such as domain, range, zeros, intercepts, and maximum and minimum values. d. Use the concepts of average rate of change (table of values) and increasing and decreasing over intervals, and use these characteristics to compare functions. <p>D5.Students express relationships recursively and use iterative methods to solve problems.</p> <ol style="list-style-type: none"> a. Express the $(n+1)$st term in terms of the nth term and describe relationships in terms of starting point and rule followed to transform one terms to the next. b. Use technology to perform repeated calculations to develop solutions to real life problems involving linear, exponential, and other patterns of change.
<p>Sample Lessons And Activities</p>	<ul style="list-style-type: none"> ▪ Generate and then analyze raw data, looking for an arithmetic or a geometric pattern, from which a sequence/ series function can be generated ▪ Apply the appropriate sequence/series function as a real-life

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	prediction tool.
Sample Classroom Assessment Methods	<ul style="list-style-type: none"> ▪ Homework ▪ Quiz ▪ Chapter exams ▪ In class data collection/analysis project ▪ Poster project
Sample Resources	<ul style="list-style-type: none"> ▪ <u>Publications:</u> <ul style="list-style-type: none"> ○ <u>Precalculus with Limits – A Graphing Approach</u> ▪ <u>Other Resources:</u> <ul style="list-style-type: none"> ○ Graphing calculator ○ A+ learning system for remediation